Use of Environmental Data by the Economic Research Service, U.S. Department of Agriculture

Over the last three decades, the USDA Economic Research Service (ERS) has analyzed many agricultural policy issues using various kinds of environmental and economic data. The agency acquires environmental data from several government agencies, universities, and other public and private organizations. However, farm surveys conducted jointly with the USDA National Agricultural Statistics Service (NASS) provide a principal source of environmental data for many research applications. The farm-level survey results, combined with information from other sources, provide a rich database for analyzing economic relationships between production technologies, resource policies, and environmental impacts. As background for the upcoming environmental data users meeting (October, 10, 2000; Washington, DC) we have briefly described several environmental issues and questions currently being addressed by ERS research, the available environmental data to support such research, and some proposed changes for future data collection. Also included is a list of some recent products of ERS research using environmental data.

Some Environmental Issues and Questions Addressed by ERS Research

Genetically Engineered Crops & New Technologies

- The effects of new technology adoption, e.g., the use of genetically engineered crops or precision input technologies, on yields, farm profits, and chemical use.
- The role of natural resources in new technology adoption, including genetically engineered crops, conservation tillage, and integrated pest management.
- The extent and rate of the diffusion of genetically engineered crops and other technologies in the U.S.

See Fernandez-Cornejo, et al., 1999, 2000, Heimlich, et al., 2000, Klotz-Ingram, et al., 1999, McBride and Brooks, 2000

Risk & Production Management

- The producer modifications of production choices and farm practices to mitigate the effect of climate and weather risks.
- The relationship between the use of alternative production management systems and farm financial performance.
- The impact of crop insurance programs on environmental quality and the feasibility of using insurance to promote the adoption of conservation practices.

See Hrubovcak, et al., 1999, Soule, et al., 1999, Daberkow and McBride, 1998, 1999, Day et al., 1999, McBride, et al., 1997

Nutrient & Pest Management

- The economic impacts of restricting agricultural uses of manure.
- The profitability and potential environmental quality effects of organic cropping methods.
- The effects of agricultural irrigation and policies on the allocation of water among agricultural, urban, and environmental uses.
- The implications of the Food Quality Protection Act on the development and use of pest management technologies.

See Barnard et al., 1997, Fernandez-Cornejo and Castaldo, 1998, Fernandez-Cornejo and Kackmeister, 1996, Fernandez-Cornejo and Jans, 1996, 1999, Fernandez-Cornejo, 1996, 1998, Fernandez-Cornejo and Ferrioli, 1999, Fernandez-Cornejo, et al., 1997, 1998, Gollehon and Caswell, 2000, Padgitt, et al., 2000, AREI 2000 Ch. 4.3 and 4.4

Wetlands and Agriculture

- The impact of alternative government incentives on the provision of wetlands and the services they provide.
- The relationship between wetland protection and improvements in water quality, flood control, wildlife habitat, and recreation.
- The roles of public and private incentives to encourage wetland protection.

See Heimlich et al., 1998, Claassen, et al., 1998, AREI 2000, Ch. 6.5

Water Quality

- The impacts of agricultural production on coastal resources, including commercial fisheries and recreation.
- The effects of various policy alternatives for reducing the water quality impacts of agriculture, including input restrictions, expected runoff restrictions, and point/nonpoint trading.
- The impacts of the concentration of animal feeding operations on water quality.
- The economic and environmental effects of alternative strategies for reducing hypoxia in the Gulf of Mexico.

See Ribaudo, et al., 1999, Doering, et al., 1999, Peters, et al., 1999, Sullivan, et al., 2000, AREI 2000 Ch. 2.3 and 6.4

Environmental Benefits from Conservation Programs

- The value of hunting, viewing of wildlife, and of water-based recreation provided by the Conservation Reserve Program and other soil and water conservation programs.
- The potential conservation and environmental effects of a "green payments" program to support farm income for selected producers, e.g., those with limited resources.

See Claassen and Horan, 2000, Feather, et al., 1998

Environmental Data and Applications for Economic Analysis

The ability to link farm operator and farming system characteristics, natural resource attributes, and economic factors gives researchers the kind of data base needed to study environmental and economic outcomes from policy changes, the introduction of new technologies, or changing economic conditions. Using geographic information system (GIS) technology or other procedures, farm-level survey data can be linked to other environmental data, including the National Resources Inventory (NRI), the National Soil Survey Inventory Information System (NASSIS), and data on ambient environmental conditions from the U.S. Geological Survey. ERS uses these data to construct complex modeling frameworks such as the U.S. Mathematical Programming

Model (USMP) to analyze the economic efficiency, environmental effectiveness, and distributional consequences of proposed policies with environmental implications. Data also are obtained from USDA agencies that administer environmental programs, e.g., conservation compliance, CRP, and WRP. Environmental data from various sources are needed to maintain up-to-date parameters in the USMP and other economic models.

The Agricultural Resource Management Study (ARMS) is a core part of the data used for ERS economic and environmental research. ARMS is an annual survey effort that is comprised of integrated surveys conducted by personal interviews with farm operators. The data are used to analyze the general performance of the agricultural sector, costs of production for selected commodities, chemical use, and adoption of production technologies. The ARMS also provides research data to address many environmental and economic issues and to support modeling activities. The stratified sampling design provides the flexibility to collect data that represent many unique segments of agriculture, including farms that produce selected commodities, farms with specific profiles, or small production regions that have high environmental risk. Each year 1 to 3 crop or livestock commodities are selected for cost of production estimates. States have used ARMS to estimate chemical use in sub-state areas that have a high risk of water quality contamination. ARMS also provides estimates for different farm classifications, including ERS farm typology classes. The ERS typology reflects characteristics of operators such as their expectations from farming, stage in the life cycle, and dependence on agriculture. The typology is used to assess how farmers may respond to farm policy changes. Another important aspect to ARMS is that it includes geographic variables that make it feasible to link farm-level survey data with spatial information, e.g., soil productivity, ambient water quality.

The farm-level surveys also provide some trend and historic perspective on the use of chemical inputs and practices. Prior to the initiation of ARMS in 1996, ERS and NASS jointly conducted several agricultural chemical use surveys beginning in 1964. Four national pesticide surveys (1964, 1966, 1971, and 1976) provide national and regional estimates of crop and livestock pesticide uses. Between 1977 and 1990, several individual commodities (corn, soybeans, wheat, cotton, fall potatoes, rice, sorghum, grapes, other deciduous fruits, and vegetables), were surveyed to determine pesticide use and to collect some pest management information. **The Cropping Practices Survey** from 1990 - 1995 obtained information for major field crops on the use of nutrients, pesticides, and production practices. The Cropping Practices surveys provided annual data on five field crops (corn, wheat, cotton, soybeans, fall potatoes) and periodic data on other crops (rice, 1990-92, peanuts, 1991, and sorghum, 1991). **The Vegetable/Fruit Chemical Use Surveys** have been used to gather the same information for selected specialty crops 1990-2000.

The Census of Agriculture and follow-on surveys related to irrigation (FRIS) and land ownership (AELOS) have been used to study the general characteristics of crop and livestock production over time. The Census is designed to be a complete enumeration of the general characteristics of all agricultural operations. However, a random sampling procedure is used to estimate a wide variety of financial and operator characteristics. The Census of Agriculture is conducted every 5 years, with the most recent in 1997. In 1996, responsibility for the Census of Agriculture was transferred from the Bureau of Census, U.S. Department of Commerce to NASS. ERS has joined NASS in the commitment to integrate the Census surveys with ARMS to the extent possible.

The National Resources Inventory (NRI), constructed by the USDA Natural Resources Conservation Service in cooperation with Iowa State University estimates land use, soil erosion, prime farmland soils, wetlands, habitat diversity, selected conservation practices, and other natural resource information. Data for the 1997 NRI were collected from more than 800,000 sample locations and are statistically reliable for national, regional, State, and sub-State analysis The 1997 NRI provides a nationally consistent data base that was constructed specifically to estimate 5- and 10-year trends for natural resources from 1982 to 1997. **The National Soil Survey Information System (NASSIS),** also developed by NRCS, provides detailed classification of soil and potential uses. These inventories, when combined with the farm survey data, provide the basis for constructing models, such as USMP, that account for resource constraints and differences among production technologies.

Ambient environmental conditions from U.S. Geologic Survey's **National Water Quality Assessment Program** and other resource monitoring programs provide important data to identify environmental problem areas and to analyze how water quality degradation coincides with soil resources and farming practices.

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Crop Residue Management surveys conducted by the Conservation Technology Information Center, West Lafayette, IN, provide data on the use of alternative crop residue management practices, including the adoption of no-till and conservation tillage. Additional information on factors affecting soil erosion, runoff, and leaching are needed to construct model parameters.

Conservation Compliance Status Review data were obtained from NRCS. In 1995 and 1997, NRCS conducted a status review of tracts previously determined to be predominately highly erodible land (HEL) using a 3 percent random sample. The sample is statistically reliable at the State level for States with large acreage of HEL and high participation in USDA programs. It is reliable at the regional level for other areas. Each tract in the sample was visited to determine the extent of compliance with the HEL provisions of the 1985 and subsequent Farm Acts.

Conservation Reserve Program (CRP) contract data were obtained from the Farm Service Agency (FSA), which develops and maintains a set of data on all tracts enrolled in the CRP, based on information provided by the program participants and observations by FSA during onsite inspections. This data set includes the type of contract, location, acreage enrolled, land capability class and subclass, rental rate paid, average soil-specific rental rate, and cost sharing.

Wetlands Reserve Program data and statistics provide summary information on acres and contracts enrolled in the WRP.

Farm Survey Proposals for 2001 and Beyond

Most aspects of the recent farm surveys collecting environmental data are expected to continue. The ARMS survey effort will continue to collect information on farm costs and expenditures, costs of production on selected commodities, pesticide treatments and pest management practices, the use of production practices and technologies on major field crops, and the demographics of farm households to construct the ERS typology classification. The flexible design of the ARMS surveys also will be used to address emerging environmental issues.

Some modifications to ARMS have been proposed to increase the ability to conduct research on a wide range of resource issues without imposing additional respondent burden. In 2001, the proposal calls for rotation of chemical use and production practice data on corn, soybeans, wheat, cotton, and potatoes. Data on chemical inputs and production practices as well as costs of production, farm costs and expenditures, and farm operation characteristics would be collected for these commodities approximately every 4 years. Some crops that have not been surveyed on a regular basis, such as rice, sugarbeets, oats, peanuts, sunflowers, and tobacco would be surveyed at more frequent intervals.

The 2000/2001 ARMS surveys will include data collection on the cost of production for sugarbeets and rice in the major production states. These surveys will have a special focus on irrigation water management practices as they affect water quality.

Corn producers will be surveyed in 2001/2002 to update cost of production estimates, chemical usage, production practices, use of GMO seeds, and the various parameters used in ERS models. Corn was last surveyed for cost of production in 1996.

Current ERS research plans place an emphasis on the analysis of environmental risk from confined animal feeding operations and on identifying possible risk mitigation options. In 2001, dairy operation will be surveyed in

21 states, and in 2002 it is proposed to survey U.S. broiler operations. In addition to the national broiler sample, special sampling is planned to represent selected areas where the broiler production is concentrated in order to study the impact of animal wastes on water quality. Hog operations were surveyed in 1999.

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